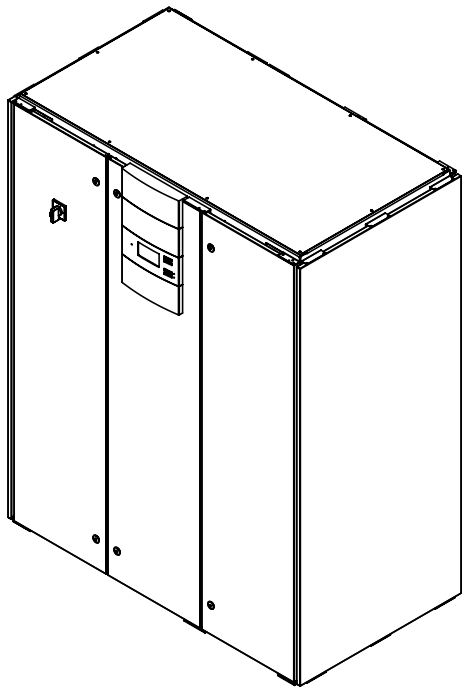
CyberChiller™ Series

Installation, Operation & Maintenance Manual



Dual Circuit
Vertical Floor Mounted
Liquid Chiller Systems

Stulz Air Technology Systems, Inc.

MODEL NOMENCLATURE

CCH-330-D-AR

OHS = Overhead System
CCH = CyberChiller System
VFS = Vertical Floor System
FCS = Floor Console System
GPS = Glycol Pump System
COS = CyberONE System
MCS = Modular Cyber System

Nominal Capacity in 1,000's of BTU/Hr

D ( ) = Dual (Two) Circuit System

AR = Air-Cooled Remote (Split)
W/G = Water/Glycol Cooled

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1.0 INTRODUCTION

1.1 General

Congratulations, the *CyberChiller*™ floor mounted liquid chiller system covered by this manual is designed and manufactured by Stulz Air Technology Systems, Inc. (SATS) using the latest, state-of-the-art control technology. Recognized as a world leader, SATS provides precision cooling systems with the highest quality craftsmanship using the finest materials available in the industry. The unit will provide years of trouble free service if installed and maintained in accordance with this manual. Damage to the unit from improper installation, operation or maintenance is not covered by the warranty.

This manual contains information for installation, operation, maintenance, troubleshooting and repair. STUDY the instructions contained in this manual. They must be followed to avoid difficulties. Spare parts are available from Stulz Air Technology Systems to insure continuous operation. Using substitute parts or bypassing electrical or refrigeration components in order to continue operation is not recommended and will VOID THE WARRANTY. Due to technological advancements, components are subject to change without notice.

CyberChiller systems are designed to precisely control leaving fluid temperature for fluid cooled equipment such as server racks, MRI's, precision cooling units or other devices. Any use beyond this is deemed to be not intended. SATS is not liable for any damage resulting from improper use. All *CyberChiller* systems are designed to be installed indoors unless otherwise noted on the equipment. Propeller-type condensers and fluid coolers are designed for outdoor use.

1.2 Product Description

CyberChiller systems are designed to meet the needs and technical requirements of individual customers. Each individual module or unit can be supplied with remote air-cooled condensers (AR) or optional water/glycol (W/G) cooled heat rejection configurations. The cooling capacity, in BTU/Hr, will depend on the unit size, which can range from 120,000 to 330,000 BTU/Hr. *CyberChiller* systems are designed to operate with either R22 or R407C refrigerant. Refer to the unit nameplate to identify which refrigerant is used with your unit.

NOTE

The *CyberChiller* systems are strictly for non-residential applications.

Refer to the installation drawing supplied with your unit for layout and dimensions of the cabinet. The *CyberChiller* unit is provided with a factory mounted service disconnect switch with a lockable handle. The service disconnect switch isolates the unit during routine maintenance. The system incorporates state of the art component protection with the use of motor start protectors and circuit breakers.

An operating manual for the system controller is provided under separate cover. Refer to that manual for detailed instructions on operating the system controller provided with your unit.

The standard controller for the *CyberChiller* unit is the C6000 microprocessor, which provides the following features: input/output monitoring status, full integrated control of cooling, multi-unit control and remote communication with building management systems. The controller is typically factory mounted on the front hinged access door of the unit. As an option the controller display may be factory supplied for remote mounting to a wall or control panel.

1.2.1 Capabilities and Features

- Dual Refrigeration Circuits
- Constant Running Compressor
- Vibration Isolation of Compressor
- Electronic Hot Gas Bypass
  (With control based on the chilled water supply temperature.)
- Heavy Gauge Cabinet Construction
- High Density Sound & Thermal Insulation

1.2.2 Application Ranges

The SATS CCH Modular Line Chiller Units are designed for operation within the following ranges:

Room Temperature Range: 35ºF to 95ºF, non-condensing environment.

Cold Water Conditions: Between 45ºF and 65ºF.

Voltage Tolerances: 460VAC +/-10%; 208VAC +/-10%.

Frequency: 60 Hz. (as noted on unit nameplate).

Max. Piping Length; Chiller to Air Cooled Condenser: 200 ft equivalent length.

Max. Level Drop; Chiller to Condenser: 20 ft (when condenser is below the chiller).

Storage Conditions: 35ºF to 95ºF.

NOTE

Damage or malfunctions to the unit due to storage or operation outside of these ranges will VOID THE WARRANTY.

1.2.3 General Design

The CyberChiller is divided into 3 areas; a pump section, a refrigeration section and an electrical section. The housing is a frame type construction. Figure 1 depicts the internal layout of the unit and the location of the major components.

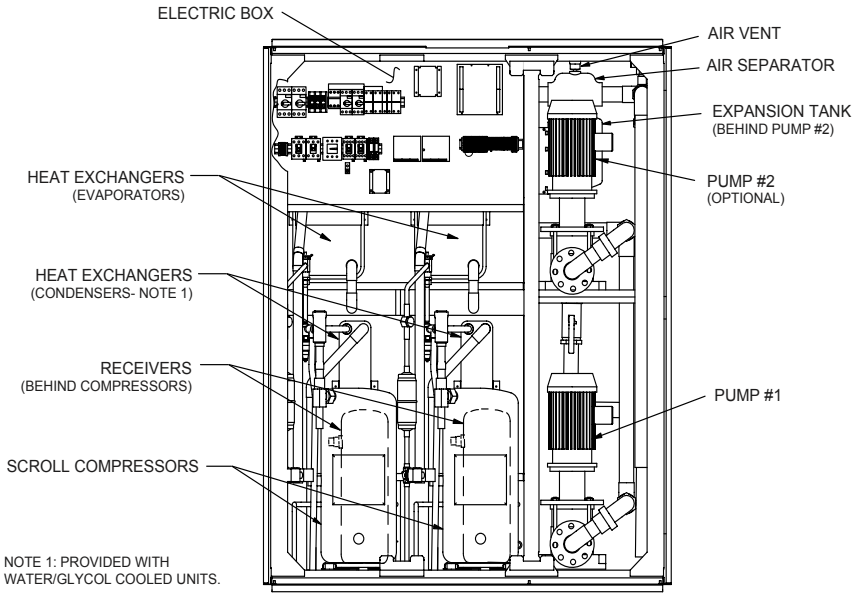


Figure 1- Typical Layout

1.2.3.1 Electric Box Access

The electrical components are protected behind dual hinged access doors located on the left side of the unit. The access doors are safety interlocked with the service disconnect switch preventing the doors from opening when the switch in the “On” position. The switch must be turned “Off” to gain access to the electrical components.

1.2.3.2 Circuit Breakers/ Motor Start Protectors

Individual overload protection is provided by circuit breaker(s) and motor start protectors. These switches must be manually re-set once the overload condition is cleared.

1.2.3.3 Pumps

Multi-stage centrifugal pumps are located in the right side of the unit to circulate the coolant through the system. A hinged access door is located on the right side of the unit. This door may be opened to gain access to the pump section.

1.2.3.4 Expansion Tank

An expansion tank has been provided on the chilled water side of the unit to compensate for thermal expansion of the coolant. An air vent is mounted on top of the fluid separator.

1.2.3.5 Heat Exchangers

Constructed of 316 stainless steel with brazed plate fin construction, the evaporator heat exchangers are for the exchange of heat from the process water/glycol coolant to the refrigerant.

1.2.3.6 Receivers

Receivers are provided for each refrigeration circuit for storage of excess refrigerant in the refrigeration cycle.

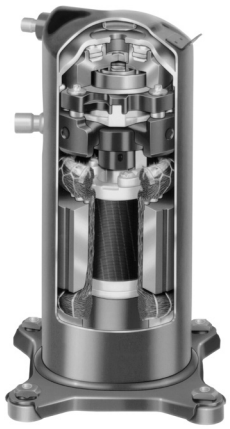
1.2.3.7 Compressors

The compressors used in this unit are scroll compressors mounted inside the unit on vibration absorbers to eliminate noise and vibration during operation. The scroll compressor is designed around two identical spirals or scrolls that, when inserted together, form crescent shaped pockets. During a compression

cycle, one scroll remains stationary while the other scroll orbits around the first. As this motion occurs, gas is drawn into the scrolls and moved in increasingly smaller pockets toward the center. At this point, the gas, now compressed to a high pressure, is discharged from a port in the center if the fixed scroll. During each orbit, several pockets of gas are compressed simultaneously, creating smooth, nearly continuous compression.

Due to the design of the scroll compressor, the internal compression components always start unloaded even if the system pressures are not balanced. In addition, since internal compressor pressures are always balanced at start-up, low voltage starting characteristics are excellent for scroll compressors

With fewer moving parts, the scroll compressor sets the industry standard for reliability among one and a half to twelve horsepower compressors. The compressor's simple design and proven day-to-day performance means less maintenance calls for field personnel.



The scroll compressor has demonstrated superior durability. Its axial and radial compliance make the scroll compressor more tolerant to liquid refrigerant and debris - two of the most common causes of system failure.

The scroll compressor is quiet, but not silent. On average, the compressor is up to five decibels quieter than standard piston compressors. A scroll compressor, however, has different sound characteristics from reciprocating compressors. These sounds do not affect system reliability or performance.

Upon shut-down of a normal run cycle, the compressor will run backwards for one or two seconds as the scrolls internal pressures are equalized. A short reverse rotation "burp" will result. This sound is normal. A check valve in the discharge tube of the compressor prevents the compressor from running backwards for more than a second or two. This normal direction reversal of the scrolls at shut down has no effect on compressor reliability.

Each scroll compressor comes equipped with a crankcase heater, used to evaporate any liquid that may have migrated to the compressor during extended periods on non-operation (>12 hours). The crankcase heaters are equipped with over current protection.

CAUTION ⚠

Prior to initial start-up (only when main power has been disconnected for 12 hours or longer), allow at least ten (10) minutes (two (2) hours is recommended) with main power reconnected. This will allow sufficient time for the crankcase heaters to evaporate any liquid that may have migrated to the compressor crankcase. When this procedure is completed, the CyberChiller is ready to be run.

Automatic, staged starting of the compressors is provided to prevent an in rush of current to the CyberChiller. High and low pressure safety switches prevent operation of the compressor during high or low pressure conditions.

1.2.3.8 Strainer

A "Y" strainer is included to remove any debris that may be circulated to the chiller.

1.2.4 Safety Features

Low and high-pressure switches are provided for each refrigeration circuit. The pressure switches are non-adjustable encapsulated control switches. If a high pressure switch is tripped for any reason, it must be manually reset. The cause for tripping of the high pressure switch must be determined. The low pressure switches are reset automatically. These pressure switches are installed as safety devices and will help prevent compressor failure or other serious damage to the system.

A flow switch is provided which will disable the refrigeration circuits if the coolant flow drops below a preset limit.

A blocked flow bypass valve is recommended for field installation to ensure proper return flow to the chiller at all times.

Manual reset circuit breakers will open to de-energize a failed component if electrical overload conditions are encountered.

1.3 Product Warranty

SATS offers a two year standard limited warranty as stated below. Additionally an extended warranty may be purchased on the unit's compressors. Consult the factory to verify if the extended compressor warranty was purchased for your system. The compressor warranty as stated on the next page will be sent with your unit and should be retained for future reference.

2-Year Standard Limited Warranty:

Stulz Air Technology Systems, Inc., warrants to the original buyer of its products that the goods are free from defects in material and workmanship. Stulz Air Technology Systems, Inc.'s obligation under this warranty is to repair or replace, at its option, free of charge to the customer, any part or parts which are determined by Stulz Air Technology Systems Inc. to be defective. The warranty is in effect for 24 months from date of shipment if a completed Warranty Registration and Start Up Form is submitted to Stulz Air Technology Systems, Inc. within 90 days from shipment. In the event that a completed start-up form is not received by Stulz Air Technology Systems, Inc. within 90 days from shipment, the company's obligation will be for a period of 12 months from date of shipment. Parts replaced under warranty are warranted for a period of 90 days from shipment or for the remainder of the unit warranty period, whichever is greater.

Stulz Air Technology Systems, Inc.'s warranty does not cover failures caused by improper installation, abuse, misuse, misapplication, improper or lack of maintenance, negligence, accident, normal deterioration including wear and tear, or the use of improper parts or improper repair as determined by SATS. This warranty does not include costs for transportation, costs for removal or reinstallation of equipment or labor for repairs or replacement made in the field.

THIS OBLIGATION AND LIABILITY OF STULZ AIR TECHNOLOGY SYSTEMS, INC. UNDER THIS WARRANTY DOES NOT INCLUDE LOSSES, DIRECT OR INDIRECT, FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. THIS WARRANY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

Optional Limited Extended Warranty (5 Years Total)

Stulz Air Technology Systems, Inc., warrants to the original buyer of its product that the compressor(s) listed below are warranted for parts replacement (not including labor) for extended period of 4 years from the date of expiration of the standard equipment warranty.

Stulz Air Technology Systems' warranty does not cover failures caused by improper installation, abuse, misuse, misapplication, improper or lack of maintenance, negligence, accident, normal deterioration including normal wear and tear, or the use of improper parts or improper repair as determined by SATS.

This warranty does not include costs of transportation, cost for removal or reinstallation of equipment or labor for repairs or replacement made in the field.

The obligation and liability of Stulz Air Technology Systems under this warranty does not include losses, direct or indirect, for incidental or consequential damages.

Compressor Serial No.: _____

Unit Model No.: _____

Unit Serial No.: _____

Stulz Air Technology Systems Job No.: _____

End User: _____

Date: _____

1.4 Safety

1.4.1 General

Stulz Air Technology Systems, Inc. uses **NOTES** along with **CAUTION** and **WARNING** symbols throughout this manual to draw your attention to important operational and safety information.

A bold text **NOTE** marks a short message in the information to alert you to an important detail.

A bold text **CAUTION** safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A bold text **WARNING** safety alert appears with information that is important for protecting you from harm and the equipment from damage. Pay very close attention to all warnings that apply to your application.

A safety alert symbol ⚠ accompanies a general WARNING or **CAUTION** safety statement.

A safety alert symbol ⚡ accompanies an electrical shock hazard **WARNING** or **CAUTION** safety statement.

1.4.2 Safety Summary

The following statements are general guidelines followed by warnings and cautions applicable throughout the manual.

Prior to performing any installation, operation, maintenance or troubleshooting procedure read and understand all instructions, recommendations and guidelines contained within this manual.

CAUTION ⚠

All maintenance and/or repairs must be performed by a journeyman, refrigeration mechanic or an air conditioning technician.

CAUTION ⚠

Never lift any component in excess of 35 pounds without help. If a lifting device is used to move a unit ensure it is capable of supporting the unit.

CAUTION ⚠

Do not allow the unit to swing while suspended from a lifting device. Failure to observe this warning may result in injury to personnel and damage to the equipment.

CAUTION ⚠

Do not allow anyone under the equipment suspended from a lifting sling.

WARNING ⚡

High voltage is used in the operation of this equipment. Death on contact may result if personnel fail to observe safety precautions.

CAUTION ⚠

When working on electrical equipment, remove all jewelry, watches, rings, etc. Keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

CAUTION ⚠

Always disconnect the main power supply to the equipment at the main power disconnect switch before beginning work on the equipment. A lock-out tag-out procedure should be followed to ensure that power is not inadvertently reconnected.

CAUTION ⚠

Equipment may contain components subject to Electrostatic Discharge (ESD). Before attempting to mount or service these electronic devices, ensure you have no charge built up by touching a ground source. When possible, use a wrist-grounding strap when working on or near electronic devices.

⚠ **CAUTION**

Never work on electrical equipment unless another person who is familiar with the operation and hazards of the equipment and competent in administering first aid is nearby.

CAUTION ⚠

All personnel working on or near equipment should be familiar with hazards associated with electrical maintenance. Safety placards/stickers have been placed on the unit to call attention to all personal and equipment damage hazard areas.

CAUTION ⚠

Ensure the unit is properly phased. Improper phasing can cause severe damage to the compressor.

WARNING ⚠

Refrigerant (R-22 or R-407C) is used with this equipment. Death or serious injury may result if personnel fail to observe proper safety precautions. Great care must be exercised to prevent contact of liquid refrigerant or refrigerant gas, discharged under pressure, with any part of the body. The extremely low temperature resulting from the rapid expansion of liquid refrigerant or pressurized gas can cause sudden and irreversible tissue damage.

As a minimum, all personnel should wear thermal protective gloves and face-shield/goggles when working with refrigerant. Application of excessive heat to any component will cause extreme pressure and may result in a rupture.

Exposure of refrigerant to an open flame or a very hot surface will cause a chemical reaction that will form carbonyl chloride (hydrochloric/hydrofluoric acid); a highly poisonous and corrosive gas commonly referred to as PHOSGENE. In its natural state, refrigerant is a colorless, odorless vapor with no toxic characteristics. It is heavier than air and will disperse rapidly in a well-ventilated area. In an unventilated area, it presents a danger as a suffocant.

Always refer to the manufacturer's MSDS provided with the unit.

WARNING ⚠

Avoid skin contact or inhaling fumes from any acid formed by burn out of oil and refrigerant. Wear gas mask if area is not thoroughly ventilated. Wear protective goggles or glasses to protect eyes. Wear rubber gloves to protect hands. Use care to avoid spilling compressor burnout sludge. If sludge is spilled , clean area thoroughly.

WARNING ⚠

When performing soldering or desoldering operations, make certain the refrigeration system is fully recovered and purged and dry nitrogen is flowing through the system at the rate of not less than 1-2 CFM (.03 - .06 M^3/minute).

CAUTION ⚠

Certain maintenance or cleaning procedures may call for the use and handling of chemicals, solvents, or cleansers. Always refer to the manufacturer's Material Safety Data Sheet (MSDS) prior to using these materials. Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvents. Wash exposed skin thoroughly after contact with solvents.

CAUTION ⚠

Do not use cleaning solvents near open flame or excessive heat. Wear eye protection when blowing solvent from parts. The pressure-wash should not exceed 30 psig. Solvent solutions should be disposed of in accordance with local and state regulatory statutes.

CAUTION ⚠

Units must be kept in its normal installed position. If the unit is not kept level and vertical, damage to the unit's compressors will result.

2.0 INSTALLATION

2.1 Receiving the Equipment

Your *CyberChiller* system has been tested and inspected prior to shipment. To ensure that your equipment has been received in excellent condition, make a visual inspection of the equipment immediately upon delivery. Carefully remove the shipping container and all protective packaging. Open the access doors and thoroughly inspect the unit interior for any signs of transit-incurred damage. If there is shipping damage, it must be noted on the freight carrier's delivery forms **BEFORE** signing for the equipment. Any freight claims **MUST** be done through the freight carrier. SATS ships all equipment FOB factory. SATS is not liable for any equipment damage while in transit. SATS can assist in the claim filing process with the freight carrier. Should any such damage be present, notify the SATS Product Support Group prior to attempting any repairs. Refer to section five of this manual for instructions.

Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies to appropriate authority.

A Data Package has been sent with your unit. It contains this manual, a supplemental microprocessor controller manual, system drawings, applicable MSDS's, other component manuals, warranty registration and other applicable instructions based on the configuration and options of your unit. The data package has been placed in your unit in a clear plastic envelope. These documents need to be kept with the unit for future reference.

NOTE

Items that have been shipped loose, such as controllers, temperature sensors, water detectors, etc., are shipped inside the air conditioner unless specified otherwise by the customer. Unpack and store these items in a safe place unless you are using them immediately.

2.2 Site Preparation

CyberChiller systems are designed with easy service access in mind. Component access doors are located on the front of the unit.

In order to have full service access through the front, no permanent obstructions should be placed within 40 inches of the front of unit.

NOTE

Working clearance requirements need to be established prior to the mounting of the unit. Refer to local and national electrical codes.

2.3 Rigging

The *CyberChiller* systems are designed to be kept in the vertical position. Move the unit with a suitable device such as a forklift, pallet jack or roller bar and dollies. Weight tables are provided on the installation drawings. Units are shipped on a skid to facilitate moving prior to installation. Units should always be stored indoors in a dry location prior to installation.

CAUTION ⚠

Units must be kept level and in the vertical position when lifting to prevent damage to the unit.

2.4 Mounting/Placement

Position unit in the desired location. *CyberChiller* systems are 100% front accessible, which allows the units to be placed in a corner or between cabinetry. (See Figure 2.)

NOTE

Allow access to the unit for routine operation, servicing and for necessary maintenance.

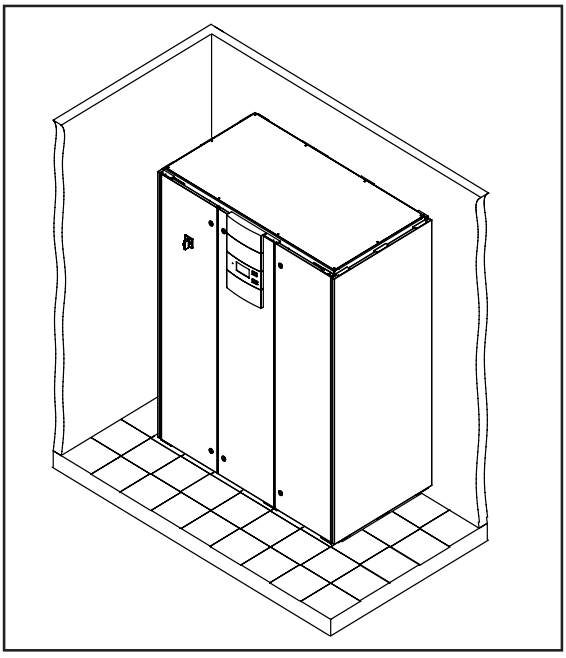


Figure 2- Typical Installation

The following general requirements should be considered during installation:

NOTE

Equipment must be level to operate properly.

2.4.1 Indoor Equipment

The *CyberChiller* system uses a frame and panel construction for unit rigidity and full service accessibility while the unit is mounted in place. The unit is designed to be located directly on top of the floor or on a raised floor installation. Ensure the mounting surface is able to support the equipment. Before mounting the unit, refer to the appropriate weight tables that are provided in the installation drawing.

2.4.2 Outdoor Equipment

Install the remote condenser or fluid cooler in a secure location where the unit cannot be tampered with and the main power circuit breaker cannot be inadvertently turned off. If possible, make use of terrain features such as trees and buildings to provide a shaded location. This will minimize the solar load on the unit. Locate the remote condenser or fluid cooler where the coils are not likely to draw dirt and debris into the coil fins. The clearance around the unit should be at least 1 times (1x) the unit's width to ensure adequate airflow to the coil.

Secure the condenser or fluid cooler so that the system will not move during operation. Refer to the installation drawing for the non-charged system weight. It is recommended that the remote condenser/ fluid cooler be mounted with field supplied vibration mounts to reduce the amount of vibration transmitted to the mounting surface.

Refer to the wiring diagram for electrical connections and to the refrigeration diagram for piping details.

2.4.3 Pump Package Installation (Water - Glycol Systems

Install the pump in general accordance with the piping diagram provided with the unit. The pump should be at least 3 feet below the height of the expansion tank. Do not form piping loops adjacent to the pump. Avoid piping very rigid lines.

If the pump will be operated at reduced capacity, a by-pass must be provided around the pump suction and discharge connections to prevent damage to the pump seals. Damage would result from insufficient liquid passing through the pump and the heat of the pump vaporizing the brine solution due to the motor's heat and the friction of the impeller housing.

It is a good idea to install a pressure gauge in the discharge line to check the pressure.

2.4.4 Optional Equipment (Field Installed)

NOTE

Do not mount any optional equipment on unit access doors.

2.4.4.1 Remote Display

The C6000 Microprocessor is the standard controller supplied with the *CyberChiller* systems. As an option a factory supplied control panel may be remotely mounted. For mounting and wiring instructions, refer to the system drawings and the supplemental manual sent in the data package with your unit.

2.4.4.2 Remote Water Detector

The optional remote water detector(s) is normally placed on the sub-floor or in a field supplied auxiliary drain pan located beneath the unit. It may be attached using double sided tape. Prepare surface before installing tape. Apply tape to the water detector and secure in place.

2.5 Piping Connections

2.5.1 Process Supply Fluid Lines

Coolant fluid supply and return lines are connected from the equipment being cooled to the *CyberChiller* via copper sweat fittings provided in the pump section.

2.5.2 Refrigerant

2.5.2.1 Split Air Cooled Systems

Split air-cooled systems with a remote condenser will require field refrigeration piping. (See Figure 3.) All split systems are shipped with a dry nitrogen charge of 50 psig.

Split systems coupled with a remote condensing unit will require a copper discharge and a copper liquid line.

All refrigeration piping should be installed with high temperature soldered joints. Use standard refrigeration practices for piping supports, leak testing, dehydration and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building by the use of vibration isolating supports. To prevent tube damage when sealing openings in walls and to reduce vibration transmission, use a soft flexible material to pack around the tubes.

Clear all pipe connections of debris and prepare the connections for soldering. Use only "L" or "K" grade refrigerant copper piping. Be careful not to allow solder/piping debris to get inside refrigerant lines. Silver solder containing a minimum of 15% silver is recommended. Dry nitrogen should be flowing through the tubing while soldering at a rate of not less than 1-2 CFM (.03 - .06 M^3/minute).

Refrigerant lines for split systems must be sized according to the piping distance between the evaporator and the condenser. Each valve, fitting and bend in the refrigerant line must be considered in this calculation. Refer to the following charts for standard equivalent lengths, in feet, of straight pipe.

Oil traps must be included in the discharge line every 20 feet in the vertical risers and the refrigerant lines must be sloped ¼ inch for every 10 feet in the horizontal lines to ensure proper oil return to the compressor. An inverted trap is required on the discharge line of the remote condenser to help prevent oil and liquid from flooding back to the compressor.

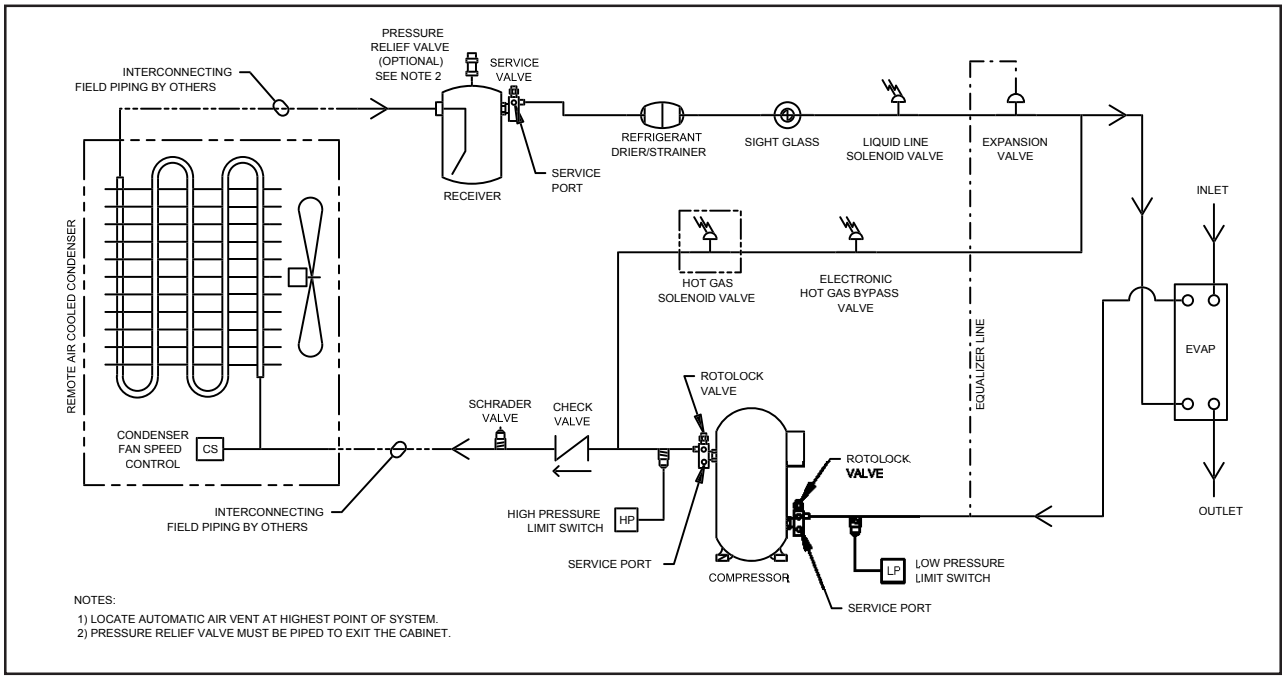


Figure 3- Typical Piping Air Cooled System

NOTE

In the following (3) charts, the line sizes represent the sizing for individual refrigeration circuits. *CyberChiller* units have two separate pairs of refrigeration lines. (One per compressor.)

Equivalent Length (ft) of Straight Pipe

OD (In.) Line Size	Globe Valve	Angle Valve	90º Elbow	45º Elbow	Tee Line	Tee Branch
1/2	9.0	5.0	0.9	0.4	0.6	2.0
5/8	12	6.0	1.0	0.5	0.8	2.5
7/8	15	8.0	1.5	0.7	1.0	3.5
1-1/8	22	12	1.8	0.9	1.5	4.5
1-3/8	28	15	2.4	1.2	1.8	6.0
1-5/8	35	17	2.8	1.4	2.0	7.0
2-1/8	45	22	3.9	1.8	3.0	10
2-5/8	51	26	4.6	2.2	3.5	12
3-1/8	65	34	5.5	2.7	4.5	15
3-5/8	80	40	6.5	3.0	5.0	17

Recommended Liquid Line Sizes

(For R-22 or R-407C Refrigerant)

Model No./ Total Unit Capacity	Receiver to Evaporator (Equivalent Ft.)*		
	50' or less	100' or less	150' or less
120 / 120,000	1/2	5/8	5/8
210 / 210,000	5/8	7/8	7/8
260 / 260,000	7/8	7/8	7/8
320 / 320,000	7/8	7/8	7/8

*Equivalent Ft. accounts for the linear pipe length as well as equivalent length of Valves, Elbows & Tee's as shown in the previous chart.

Recommended Discharge Line Sizes

(For R-22 or R-407C Refrigerant)

Model No./ Total Unit Capacity	Equivalent Length Ft.*		
	50' or less	100' or less	150' or less
120 / 120,000	7/8	1-1/8	1-1/8
210 / 210,000	1-1/8	1-1/8	1-3/8
260 / 260,000	1-1/8	1-3/8	1-3/8
330 / 330,000	1-1/8	1-3/8	1-3/8

NOTE

Vertical runs are based on a total rise of 30 equivalent feet. For longer sizes, individual calculations must be made. Sizes assume the use of single risers; double risers may be necessary.

*Equivalent Ft. accounts for the linear pipe length as well as equivalent length of Valves, Elbows & Tee's as shown in the previous charts.

2.5.2.2 Water/Glycol Fluid Cooled Systems

Piping connections for the water/glycol fluid coolers are sweat connections. (See Figure 4.) Pipe sizes may not necessarily be the same as the unit connection. Piping should be sized to match the system pressure drop and pump capacity and may require a reducing fitting to match the connection size on the pump package and *CyberChiller*.

Copper is adequate for closed loop systems and ground water which is not high in mineral content and is pH neutral. In situations where scaling could be heavy, or where biological growth will be present, a closed loop system is recommended. Untreated water in the unit heat exchangers may cause, over a period of time, a loss of heat exchange capacity due to a mineral deposit build-up inside the exchanger. Only a qualified service mechanic should clean these.

Glycol-cooled systems with low entering fluid temperatures should have insulated piping. The recommended ethylene glycol solution ratio is 40% glycol to 60% water. (SATS recommends Dowtherm SR1 manufactured by Dow Chemical Co.) Use only ethylene glycol with inhibitors for corrosion protection.

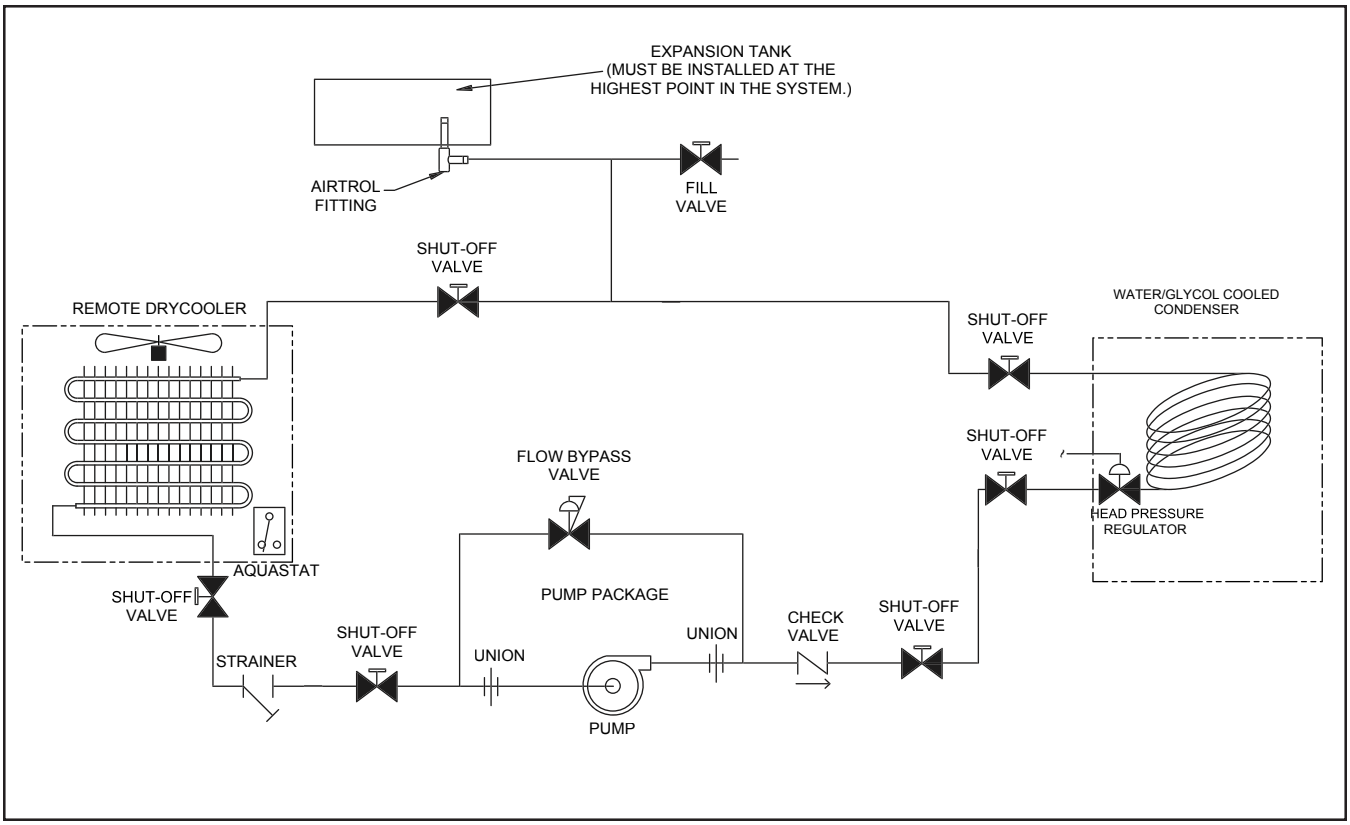


Figure 4- Typical Piping Water/Glycol Cooled System

WARNING ⚠

Glycol is hazardous. Consult the manufacturer's MSDS for detailed safety information.

CAUTION ⚠

When installing and filling the water/glycol loop all air must be bled from the piping system and the piping system must be cleaned prior to operating the system. Failure to do so will result in equipment problems.

2.5.3 Pump Package

2.5.3.1 Suction Side Piping

Install a concentric reducer at the pump suction opening and make all suction piping at least one-(1) size larger than the diameter of the suction inlet. If necessary, install a suction strainer with a net area 2-3 times larger than the suction piping. The piping leaving the drycooler should enter the pump suction port. Install a ball valve in the suction line for maintenance purposes.

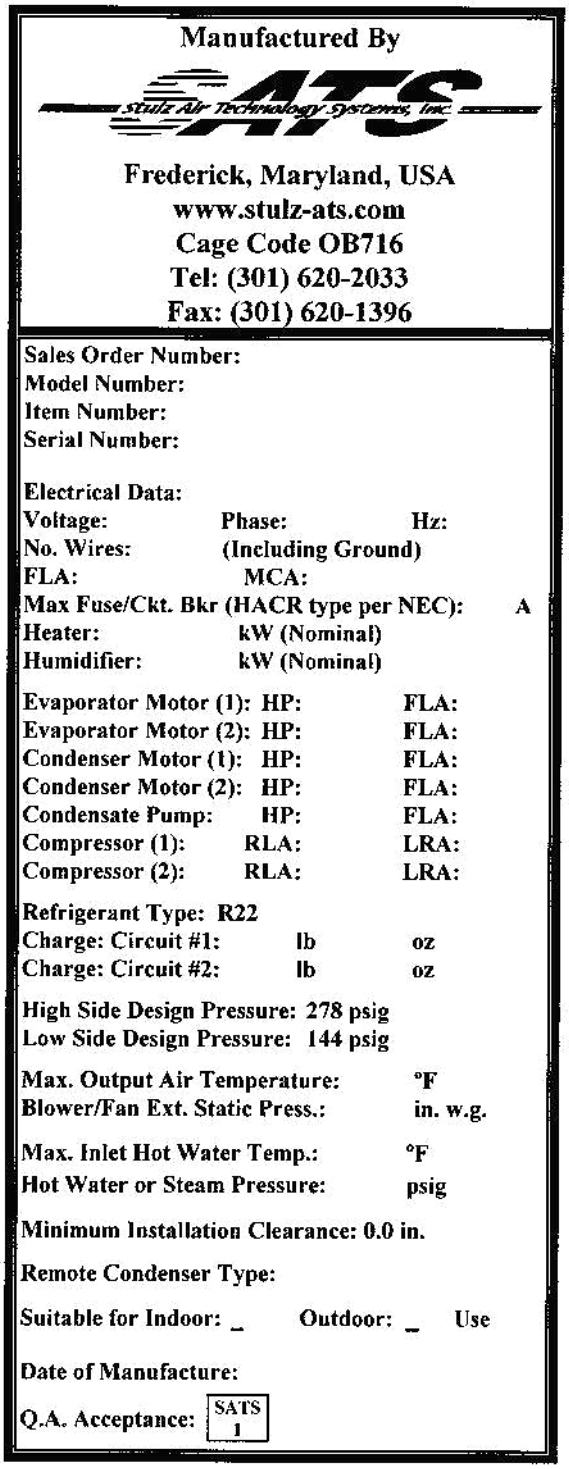
2.5.3.2 Discharge Side Piping

Install a concentric reducer at the pump discharge opening and make all discharge piping at least one-(1) size larger than the diameter of the discharge outlet. Install a check valve in the discharge line to prevent back flow that may damage the pump on shut down. Install a ball valve in the discharge line for maintenance purposes.

2.6 Utility Connections

2.6.1 Main Power

The *CyberChiller* product offering is available in 208-230 VAC single-phase or 460 VAC three-phase configurations. It is imperative that the unit nameplate be examined to determine the operating voltage, frequency and phase of the system. (See Figure 5.) The nameplate also provides the full load amps (FLA), the current that the unit will draw under full design load, the minimum circuit ampacity (MCA) for wire sizing, and the maximum fuse or HACR (Heating, Air Conditioning, Refrigeration) breaker size (MAX FUSE/


Manufactured By

Stulz Air Technology Systems, Inc.

Frederick, Maryland, USA
www.stulz-ats.com
Cage Code OB716
Tel: (301) 620-2033
Fax: (301) 620-1396

Sales Order Number:
Model Number:
Item Number:
Serial Number:

Electrical Data:
Voltage: Phase: Hz:
No. Wires: (Including Ground)
FLA: MCA:
Max Fuse/Ckt. Bkr (HACR type per NEC): A
Heater: kW (Nominal)
Humidifier: kW (Nominal)

Evaporator Motor (1): HP: FLA:
Evaporator Motor (2): HP: FLA:
Condenser Motor (1): HP: FLA:
Condenser Motor (2): HP: FLA:
Condensate Pump: HP: FLA:
Compressor (1): RLA: LRA:
Compressor (2): RLA: LRA:

Refrigerant Type: R22
Charge: Circuit #1: lb oz
Charge: Circuit #2: lb oz

High Side Design Pressure: 278 psig
Low Side Design Pressure: 144 psig

Max. Output Air Temperature: °F
Blower/Fan Ext. Static Press.: in. w.g.

Max. Inlet Hot Water Temp.: °F
Hot Water or Steam Pressure: psig

Minimum Installation Clearance: 0.0 in.

Remote Condenser Type:

Suitable for Indoor: _ Outdoor: _ Use

Date of Manufacture:

Q.A. Acceptance: SATS 1

Figure 5- Sample Nameplate

CKT BKR) for circuit protection. The unit's nameplate is located inside the cabinet within the electrical box.

NOTE

If the nameplate states MAX FUSE/CKT BKR, it is required to utilize fuses or HACR type circuit breakers to protect the system. Other protection devices are not allowed based upon the product listing.

Each unit is provided with terminals for all required field-wiring connections, (supplied by others). Refer to the electrical schematic supplied with the unit for all power and control field-wiring connections. It is important to identify the options that were purchased with the unit in order to confirm which field connections are required.

WARNING

High voltage is used in the operation of this equipment. Death on contact may result if personnel fail to observe safety precautions.

WARNING

Verify power is turned off before making connections to the equipment.

NOTE

All wiring must conform to local and national electrical code requirements. Use of copper conductors only is required. Wiring terminations may become loose during transit of the equipment; therefore, it is required to verify that all wiring terminations are secure.

It is important to verify that the main power supply coincides with the voltage, phase and frequency information specified on the system nameplate. The supply voltage measured at the unit must be within ±10% of the voltage specified on the system nameplate.

A manual fused disconnect switch or HACR type circuit breaker must be installed per local and national electrical codes for service of equipment. Do not install a customer supplied manual fused disconnect switch or HACR type circuit breaker to the surface of the unit.

Each unit is provided with main power and control terminal positions for connection of the field-wiring. The opening for the conduit is located in the floor of the cabinet. A label stating "MAIN POWER INPUT" is in close proximity. The main power wires are terminated at the line side of the service disconnect switch located within the electric box. (See Figure 6.) A separate equipment ground lug is provided within the electrical box for termination of the earth ground wire. Terminals are available as an interface to a dry contact, (N.O./N.C.), relay for a remote alarm status signal.

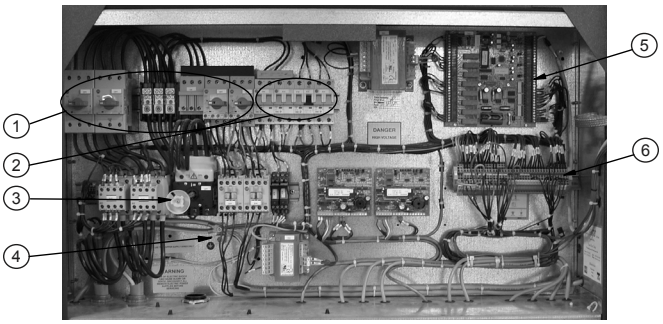


Figure 6- Electric Box

The number call outs in Figure 6 coincide with the numbered items listed below.

1. Power Switches/Motor Starter Protectors
2. Control Circuit Breakers
3. Service Disconnect Switch
4. Ground Lug
5. Control I/O Board
6. Interface Terminals

CAUTION

Improper wire connections will result in the reverse rotation of the pumps and compressor (if applicable) and may eventually result in damage to the scroll compressor. To correct this problem, exchange any two of the incoming main power wires at the main power circuit breaker. Do NOT rewire the unit's individual components.

Prior to unit operation, an adequate unit-to-earth ground must be connected to the unit.

2.6.2 Controls

Stulz Air Technology Systems offers the C6000 Microprocessor as the standard controller for the *CyberChiller* system. If it is mounted on the unit (standard), no utility connection is required. As an option a factory supplied display may be remote mounted. A six-conductor cable harness is provided for interconnect wiring. Refer to the electrical drawings supplied with your unit for details on interconnecting field wiring.

2.6.3 Optional Equipment

NOTE

All wiring must be provided in accordance with local and national electrical code requirements.

2.6.3.1 Remote Water Detector

The optional remote water detector requires two conductors to be wired to the control terminal board within the unit electrical box. The wire insulation must be rated at 600V. The water detector includes screw type terminals for wire connections. Refer to the supplied electrical schematic for proper wire terminations.

2.6.4 Interconnecting Field Wiring

The following system interconnecting field wiring sections detail the wiring required for a typical system. Additional control conductors may be required depending on the options purchased with the equipment. Refer to the supplied electrical drawings to determine the total number of interconnecting conductors required for your system. It is important to note that the control transformer(s) supplied with the equipment are sized and selected based upon the expected loads for each system.

CAUTION

Do not connect any additional loads to the system control transformers. Connecting additional loads to the factory supplied control transformer may result in overloading of the transformer, which will cause the transformer circuit breaker to trip.

NOTE

All wiring must be provided in accordance with local and national electrical code requirements.

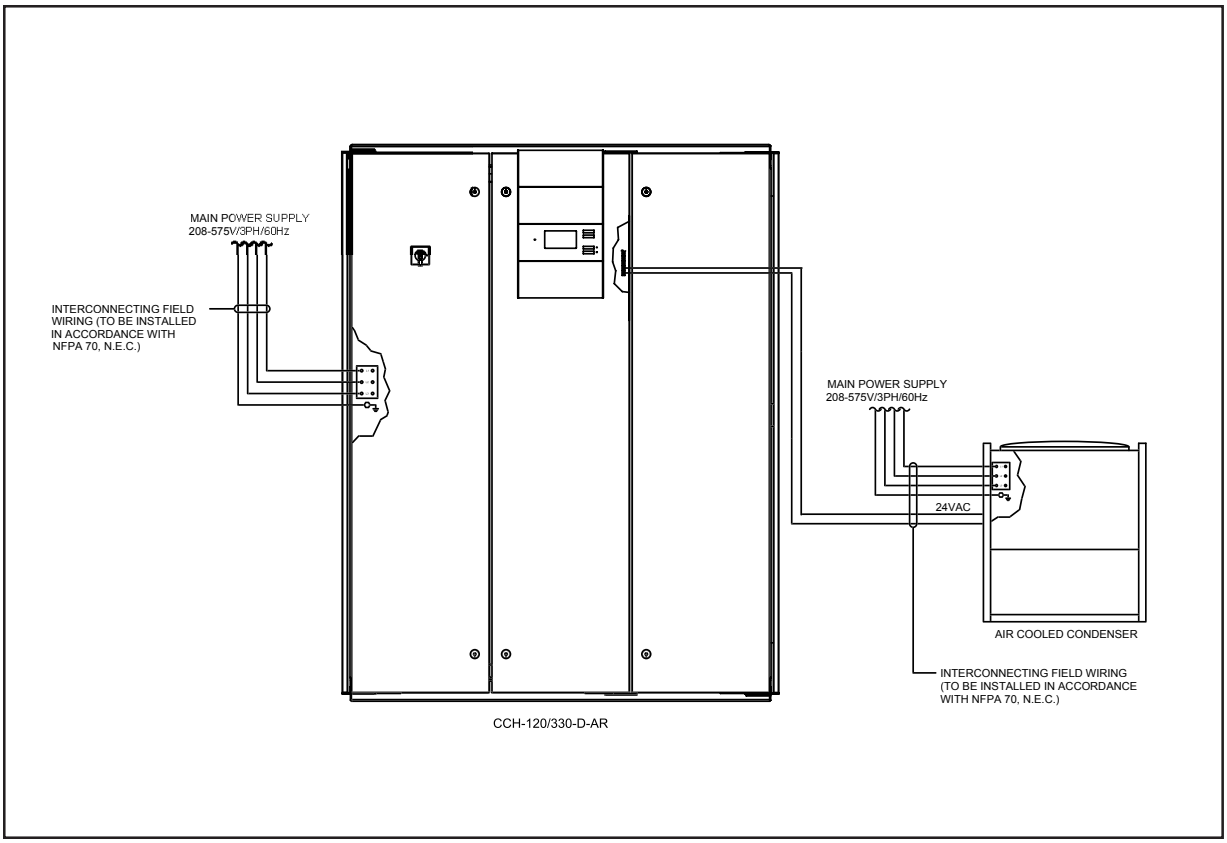


Figure 7- Interconnecting Field Wiring Remote Condenser

2.6.4.1 Air-Cooled Split System Remote Condenser

See Figure 7. Systems equipped with a remote condenser require field wiring between the evaporator system and the remote condenser. Refer to the wiring diagram supplied with the condenser (typically located in the condenser electric box).

The installer must provide main power wiring to the main power distribution block located within the remote condenser control box. A separate equipment ground lug is provided within the electrical box for termination of the earth ground wire.

The installer must also wire two control conductors from the terminal board within the evaporator unit to the control terminal board within the remote condenser control box. Refer to the supplied electrical schematic for proper wire terminations.

2.6.4.2 Glycol Systems With Outdoor Fluid Pump Package

See Figure 8. Systems equipped with a glycol system pump package require field wiring between the drycooler unit and pump package. The installer must wire two control conductors from the terminal board within the drycooler to the pump package electrical box. Refer to the supplied electrical schematic for proper wire terminations.

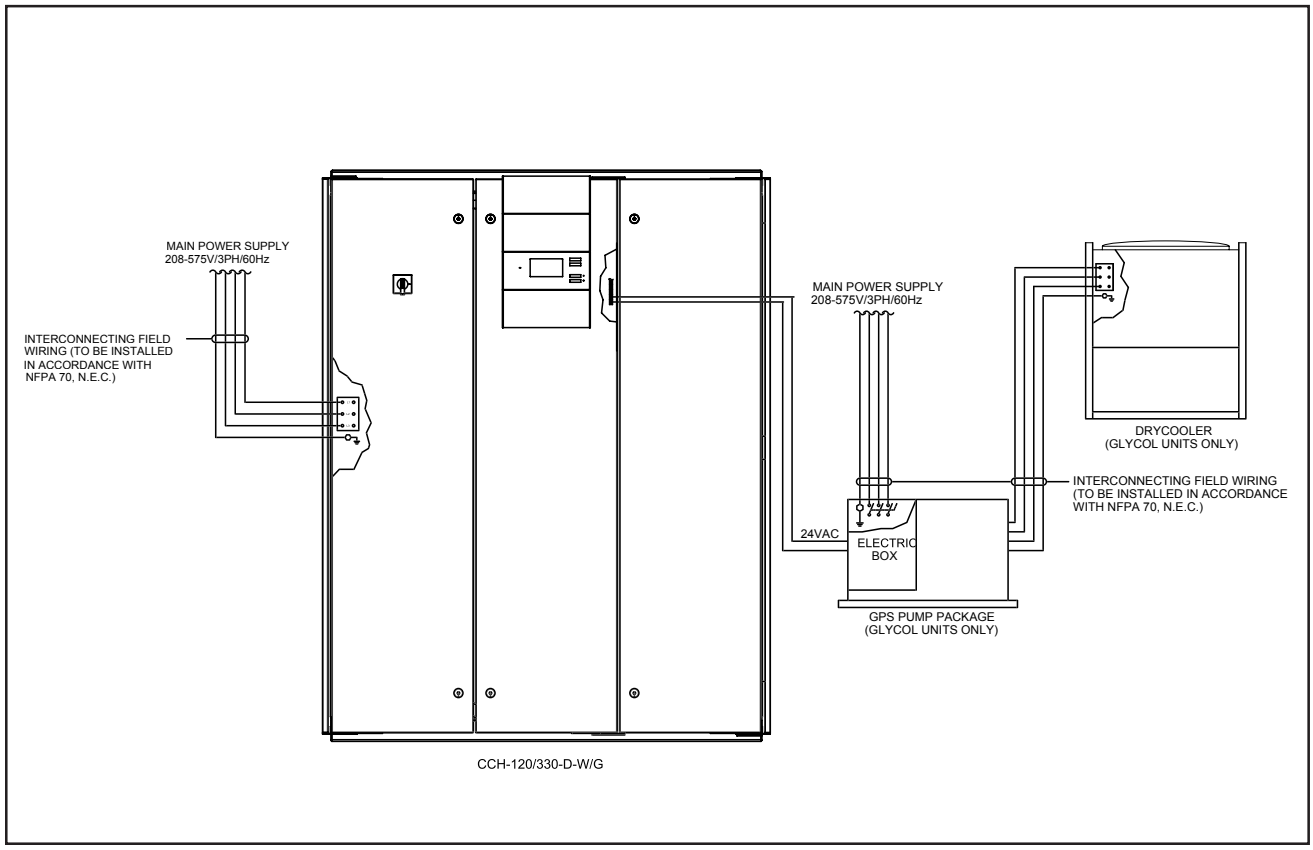


Figure 8- Interconnecting Field Wiring Glycol Systems

2.7 System Settings and Adjustments

2.7.1 Chilled Water Supply Charging Procedures (Evaporator Side)

2.7.1.1 Pump Start-Up

Fill the system with potable water before turning the pump on. These pumps are not self-priming, so it is important that there is a pressure on the suction inlet.

CAUTION ⚠

Do not run the pump dry.

If the pump has no pressure on the discharge side, leave the discharge valve partially shut to create a back pressure in the pump so that liquid volume can build up in the impeller housing to keep the impeller housing from getting too hot. Make sure there is always liquid leaving the pump, indicating that there is flow in the pump to cool the impeller and housing. If there is no flow shut the pump off immediately to prevent damage to the pump. Check for proper rotation of the motor observing the arrow on the side of the impeller.

CAUTION ⚠

The pumping system of the *CyberChiller* is designed for use with a positive suction head. At no point should the system be operated for an extended period of time with less than 5 to 10 psig at the pump inlet pressure fitting.

NOTE

The piping system must be clean prior to operating the system

1. Connect the water source to the drain valve hose bib.

2. Open the vent valve at highest point of the system.

3. Open the water source and run until the water solution is discharging from the vent with minimal signs of foaming due to air in the system.

4. Allow pump to run until 30 psig is indicated on the pressure gauge at the pump inlet fitting.

5. Ensure water side is completely filled without air voids. Check and verify proper flow rate is obtained before starting the compressors.

CAUTION ⚠

Extensive operation of the circulating pump with the compressors disabled may cause damage from the abnormally high water/glycol temperature developed.

5. Observe the pressure on the pressure gauge connected to the chiller pump inlet fitting. Maintain 20 to 30 psig on the pressure gauge.

CAUTION ⚠

Improper setting of the heat exchanger flow switch may result in freezing of the heat exchanger, and system failure not covered by warranty. Only qualified individuals should perform this procedure.

2.7.1.2 Strainer Cleaning

NOTE

During initial operation the "Y" strainer will trap the majority of the particulate left in the system as a result of various manufacturing processes. The Strainer MUST be cleaned every 30 minutes during the first 3 hours of operation to ensure adequate flow of coolant. (See below.)

1. Switch both compressors to the "OFF" position.

2. Isolate the "Y" strainer by closing isolation valves.

3. Unscrew the brass fitting from the "Y" strainer and pull the screens out.

4. Wash the screens thoroughly to remove the collected particulate.

5. Reinstall the screens in the strainer housing and replace the brass fitting.

6. Re-open isolation valves.

7. Resume unit operation. Repeat steps 1 – 6 every 30 minutes for first 3 hours operation.

2.7.2 Outdoor Heat Exchanger Glycol Charging Procedures

In glycol cooled units the refrigerant system is already charged with R-22 or R407C.

The following precautions must be observed when installing and filling the glycol loop:

- The glycol must be ***mixed*** with water ***before*** it is added to the system. All ***air*** must be ***bled*** from the piping system.
- The ***piping*** system must be ***cleaned*** prior to adding the glycol solution to the system.
- Use only ***water glycol solution*** with ***inhibitors*** for corrosion protection.

2.7.3 R-22 Refrigerant Charging Procedures

NOTE

Refrigerant charging must be performed by a journeyman, refrigeration mechanic or an air conditioning technician.

2.7.3.1 Remote Air-Cooled Split Systems

Remote air-cooled units come equipped with a factory dry nitrogen holding charge, which must be removed before piping and charging the unit.

PREPARING SYSTEM FOR CHARGING

1. Once all connections have been made, pressurize the system to 150 psig with dry nitrogen. Leaks may be detected by observing the standing pressure.

2. After ensuring there are no leaks, relieve pressure and evacuate the system. Pull a vacuum of 50 microns or less using the suction and discharge service ports and the service port of the receiver (if applicable). Hold the vacuum for 2 hours. Ensure no portion of system has been isolated from the evacuation process (liquid, suction or discharge lines).

CAUTION ⚠

A proper vacuum must be drawn on the refrigerant system prior to charging. If this is not done the refrigerant will combine with the moisture in the pipes to form an acid that will eventually cause compressor failure.

FINE TUNING THE SYSTEM CHARGE

2.7.3.2 -20ºF Variable Speed Control

The following instructions are for charging systems with condenser fan cycling or variable speed control using R-22 refrigerant.

1. Bleed air from hoses and "break" the system vacuum by supplying R-22 **vapor**. Supply R-22 **vapor** until the pressure is raised to about 50 psig. This small holding charge allows the low pressure switch to “make” throughout the process of fine tuning the system charge

WARNING ⚠

Do not add **liquid** R-22 refrigerant to the suction side of the system.

2. Start the system and use the microprocessor controller to lower the supply water temperature set-point 3-5°F below actual water temperature. This will ensure the cooling mode stays on during the charging procedure.

CAUTION ⚠

An adequate heat load must be supplied to the unit to ensure a proper charge.

3. Supply R-22 vapor to the suction port until the liquid line sight glass is cleared of all bubbles.

4. After the unit has stabilized, the liquid line sight glass should be clear and the discharge pressure should be a minimum of 200 psig. A superheat reading should be taken 6 inches from the compressor, with the temperature-measuring device being well insulated. The superheat should be approximately 10-12 ºF.

5. A sub cooling reading should be taken on the output side of the condenser, with the temperature-measuring device being well insulated. The sub-cooling temperature should be approximately 10-20 ºF.

NOTE

Under cold climate conditions it is recommended to do the following:

6. Block off the intake air to the condenser with cardboard (or reduce the water glycol flow) until a constant discharge pressure (225-280 psig) can be obtained. This will lower the possibility of overcharging and avoid the occasional bubbles that may appear in the sight glass during fan cycling.

7. Ensure the crankcase heater is operational by checking the amperage.

CAUTION ⚠

Remove the blockage to the air intake of the condenser (or restore the water/glycol flow).

9. Fill out applicable blocks of Warranty Registration and Start-Up Checklist.

2.7.4 R407C Refrigerant Charging Procedures

R-407C is a blended refrigerant recognized for being safer for the environment. Refrigerants that are multi-component blends have component parts with different volatilities that result in a change in composition and saturation temperature as evaporation and condensation occur. Typically the composition of R-407C vapor is different than that of R407C liquid within a contained system. The composition of liquid R-407C refrigerant remains relatively constant, however, the refrigerant vapor tends to separate into its component parts even when circulating. When charging a system using blended refrigerants, it is essential that the composition of the refrigerant is maintained. To ensure correct composition, introduce R-407C into the system in liquid form rather than vapor form. Cylinders which are not provided with dip tubes should be inverted to allow only **liquid** refrigerant to charge the system. Keeping the temperature of the cylinder below 85°F will help to maintain the correct refrigerant composition while the cylinder is emptied.

CAUTION ⚠

POE oil is used in systems with R-407C refrigerant. POE oil quickly absorbs moisture when exposed to air. High POE oil moisture levels react with refrigerant to form acid, which results in system contamination. Keep entire system sealed as much as possible and minimize exposure of POE oil to outside air. Familiarize yourself with the charging procedures discussed in section 2.7.3 of this manual. Instead of adding R-22 vapor to the suction port as described under "Preparing System For Charging", the initial charge will be performed by introducing R-407C **liquid** to the discharge side of the compressor.

PREPARING SYSTEM FOR CHARGING

1. With all the system piping connections made, perform a dry nitrogen leak detection test on the system. Using dry nitrogen only, pressurize the system to 150 psig. Since there is no refrigerant in the system to detect, leaks may be detected by observing the standing pressure.

2. After ensuring there are no leaks, evacuate the system to 50 microns and hold the vacuum for 2 hours.

3. Break the vacuum by supplying R-407C **liquid** to the discharge port near the compressor until the pressure is raised to about 50 psig. This small holding charge allows the low pressure switch to "make" through the process of fine tuning the system charge.

FINE TUNING THE SYSTEM CHARGE

4. Disconnect the refrigerant cylinder from the discharge side of the compressor and connect it to the suction side.

5. Start the system and use the microprocessor controller to lower the supply water temperature setpoint 3-5°F below actual water temperature, ensuring cooling remains on as the unit is charged.

6. Allow the discharge pressure to rise to 225-280 psig and hold it constant. On cool days it may be necessary to restrict the airflow across the condenser (or reduce the water glycol flow), to raise the pressure.

7. Slowly meter R-407C **liquid** refrigerant through the suction side while watching the sight glass to clear of bubbles.

CAUTION ⚠

Add liquid refrigerant **slowly** to prevent the refrigerant oil from "washing out" of the compressor.

8. While monitoring the sight glass, take a sub-cooling temperature reading on the output side of the condenser. The sub-cooling temperature should be 10-12°F.

9. If necessary, add **liquid** refrigerant to maintain adequate sub-cooling temperature.

10. Take a superheat reading on the suction line 6" from the compressor. The superheat should be 12-20°F.

2.7.5 High/Low Pressure Limit Switch

CyberChiller units utilizing thermal expansion valves are equipped with hermetically sealed high-pressure and low-pressure switches. These switches are preset by the manufacturer and cannot be adjusted. The high pressure switch will open the control circuit to disengage power to the compressor contactor if the discharge pressure rises above a specific pressure. The high pressure switch also triggers an alarm signal at the controller. To restore operation of a compressor after shut down due to high or low pressure, re-set the alarm at the remote panel. If a compressor was disabled due to high pressure conditions, a manual reset of the high pressure safety switch is also required. The high-pressure switch opens at 410 psig and has a manual reset.

The Low pressure switch will open the control circuit to the microprocessor digital input to disengage power to the compressor contactor if suction pressure drops below a specific pressure. The microprocessor will ignore the absence of this signal during the cold start delay period after starting of a compressor. Should this signal continue to be absent or open after the cold start period, the affected compressor will be shut down with an alarm indication at the controller. The low-pressure switch opens at 10 psig (± 4) and closes at 32 psig (± 5) and has an automatic reset.

2.7.6 Head Pressure Controls

2.7.6.1 Air-Cooled Systems

2.7.6.1.1 Condenser Fan Speed

Remote air-cooled condensers use variable speed condenser motor control to maintain head pressure. The variable speed motor is located closest to the header end of the condenser. The fan speed control is a continual modulation of the motor's speed. As the condenser discharge pressure rises, the fan speed increases, cooling the condenser which lowers the discharge pressure. The controller is mounted in an electrical box for field installation or could be pre-packaged with the outdoor condenser. Mount the condenser control box on the header end of the condenser. The fan speed controller requires no adjustments.

Ensure the wiring to the condenser is in accordance with appropriate codes and the electrical schematic. On systems with more than one fan on the condenser, the remaining motors cycle on and off through additional thermostat(s).

2.7.6.2 Water/Glycol-Cooled Systems

2.7.6.2.1 Head Pressure Regulating Valve

In a water/glycol condenser, condensing temperature is maintained by the liquid flowing through a regulating valve and then into a brazed plate liquid-cooled condenser. The regulating valve opens to increase liquid flow as the pressure rises (or closes as the refrigerant pressure falls). The regulating valve is factory set for the correct condensing temperature however, it can be adjusted to increase or decrease the condensing temperature as follows:

Head pressure regulating valves are available in 2-way or 3-way configurations. 3-way valves are available with pressure ratings of 150 and 300 psig. The location and method for adjusting the valves for condensing pressure differs with the valve types. To increase the condensing temperature, decrease water/glycol flow. To decrease the condensing temperature, increase the water/glycol flow. A directional arrow is stamped on the metal housing of the valve stem.

2.7.7 Thermal Expansion Valve

CyberChiller units utilize a thermal expansion valve (TEV) to control the flow of refrigerant entering the evaporator in order to maintain a constant superheat of the refrigerant vapor at the outlet of the evaporator. Superheat is the difference between the refrigerant vapor temperature and its saturation temperature at that pressure. By controlling superheat, the TEV keeps nearly the entire evaporator surface active while not permitting liquid refrigerant to return to the compressor.

The standard superheat is factory set at 12-20°F and should not need adjustment. If adjustment should be required, remove the cap from the valve. Turn the adjusting stem clockwise to increase the superheat and counter clockwise to decrease the superheat.

2.7.8 Hot Gas Bypass

The hot gas bypass system provides some modulated capacity control and freeze protection. The hot gas bypass system consists of a discharge bypass valve that allows some hot gas from the compressor discharge line to flow directly to the evaporator, in order to maintain the fluid leaving temperature.

The hot gas bypass system also provides freeze protection for the evaporator coil by limiting the minimum refrigerant pressure, thereby preventing the surface temperature of the evaporator coil from dropping into the freezing range.

The hot gas bypass valve is automatically controlled by the Chiller's unit mounted controller. The hot gas bypass valve will begin to open, allowing hot gas refrigerant to enter the evaporator once the leaving water temperature falls to the leaving water temperature setpoint.

2.8 Refrigerant Characteristics

2.8.1 Pressure/Temperature Settings

The following chart is provided to assist with the normal settings of the system for R-22 and R407C refrigerant. Where applicable, minimum and maximum settings are given along with normal operating pressures.

Pressure/Temperature Settings For R-22 & R407C			
	Normal	**Min.**	**Max.**
Sub-cooling°F	10	5	20
Superheat°F	15	10	20
Condensing Temperature Air-Cooled°F	125	105	140
Condensing Temperature Water-Cooled°F	105	105	140
Condensing Temperature Glycol-Cooled°F	130	105	140
Suction Pressure (psig)	70	58	84
	Opens	**Closes**	
Low Pressure Switch (psig)	10	32	
High Pressure Switch (psig)	410	Manual Reset	

2.8.2 Saturated Refrigerant Pressure Tables

The following refrigerant vapor pressure tables are provided for reference.

R-22 Refrigerant

Temp. (°F)	Pressure (psig)
20	43.2
22	45.5
24	47.8
26	50.2
28	52.6
30	55.1
32	57.7
34	60.4
36	63.1
38	65.9
40	68.7
42	71.7
44	74.7
46	77.8
48	81.0
50	84.2
55	92.7
60	102
65	111
70	122
75	132
80	144
85	156
90	168
95	182
100	196
105	210
110	226
115	242
120	260
125	278
130	296
135	316
140	337

R-407C Refrigerant

Temp. (°F)	Pressure (psig)
Superheat	
20	37.0
22	39.1
24	41.3
26	43.6
28	46.0
30	48.4
32	50.9
34	53.5
36	56.2
38	58.9
40	61.7
42	64.6
44	67.6
46	70.7
48	73.8
50	77.1
Sub-cooling	
95	206
100	222
105	239
110	257
115	275
120	294
125	315
130	336
135	358
140	381

Dew Point (Saturated Vapor)

Bubble Point (Saturated Liquid)

3.0 START-UP/COMMISSIONING

3.1 Operation

For new installations, ensure the unit is ready to operate by going through the Checklist for Completed Installation, located in Appendix A, prior to start-up.

NOTE

A Warranty Registration and Start-Up Checklist is provided with the unit data package. It should be completed during start-up and sent to SATS. This checklist should be used as a guideline for items that need to be confirmed during start-up.

Start-up must be performed by a journeyman, refrigeration mechanic or an air conditioning technician.

3.2 Step by Step Start-Up Instructions

1. Replace all equipment removed prior to performing start-up checks.
2. Apply power to start the CyberChiller system at the main power disconnect switch.

NOTE

The compressor(s) may have a time delay on start-up.

Both refrigeration circuits must be tested at start-up. There are several ways to force the second circuit into operation. Refer to the separate controller operation instructions sent with your unit in the data package.

3. Test cooling operation by adjusting the leaving fluid temperature setpoint. The compressor should come on and the chilled water supply should gradually drop in temperature.

3.2.1 Operational Description

3.2.1.2 Compressor

1. Compressor starts.
2. The compressor takes low pressure, low temperature gas and compresses it to a high temperature, high pressure gas.
3. The refrigerant then flows to the condenser coil. The high temperature, high-pressure gas from the compressor is cooled by the flow of water/glycol/air through the condenser coil and is changed into a low temperature, high-pressure liquid.
4. The low temperature, high-pressure liquid refrigerant then flows to the receiver. The receiver acts as a storage tank for the liquid refrigerant that is not in circulation.
5. The refrigerant drier/strainer removes any moisture (water vapor) or impurities that may be carried by the liquid refrigerant.
6. The refrigerant then flows through the liquid sight glass. This device indicates the presence of moisture and state of refrigerant in the system.
7. The liquid line solenoid valve controls the flow of refrigerant before going to expansion valve, which controls the amount of liquid refrigerant to the heat exchanger. The expansion valve senses the temperature and pressure of the refrigerant as it leaves the heat exchanger. By use of a sensing bulb and an external equalizer line the valve constantly adjusts the flow of liquid refrigerant to the heat exchanger.
8. As the liquid refrigerant leaves the expansion valve it enters the heat exchanger. The evaporation of the liquid refrigerant within the heat exchanger removes heat from the water coolant.
9. The refrigerant gas is then drawn back to the compressor and the cycle is repeated.
10. Hot gas from the compressor discharge line is injected into the inlet of the heat exchanger by the hot gas bypass regulator valves. The system controller signals the hot gas regulator valves to proportionally vary the rate of hot gas being injected into the inlet of the heat exchanger as a function of the supply coolant temperature sensed. The hot gas will mix with the refrigerant from the expansion valve. The expansion valve will meter the flow of liquid refrigerant as needed to maintain super heat to approximately 9° - 11°F.
11. The hot gas valve(s) act together with the expansion valve(s) to control the temperature of the supply coolant.

3.2.1.3 Coolant System

The water coolant system is a closed loop re-circulating system. The pressurized supply coolant flows through the electronics equipment removing heat and then is returned to the expansion tank inside the *CyberChiller*. The fluid is pumped from the expansion tank through the system heat exchanger where heat is removed from the fluid. After cooling, the fluid is re-

supplied to the equipment. The flow switch senses the coolant flow in the system. When the pump is operating, the coolant flow in the piping actuates the flow switch. The switch will signal the system controller to disable compressors and expansion valves and close the hot gas valves if the coolant flow rate drops.

NOTE

During initial operation the “Y” strainer will trap the majority of the particulate left in the system as a result of various manufacturing processes. The strainer MUST be cleaned every 30 minutes during the first 3 hours of operation to ensure adequate flow of coolant.

3.2.1.4 Water/Glycol Outdoor Fluid Cooler

On a call for cooling the dry contacts on the drycooler control relay in the CyberChiller’s electric box close the 24 VAC circuit from the “powered pump package” and turn on the drycooler and pump.

An Aquastat cycles the dry cooler fan(s) on and off to maintain an 85°F glycol temperature. As the glycol temperature rises above 85°F the aquastat starts cycling the drycooler fan **ON** to maintain 85°F glycol temperature.

3.2.1.4.1 Dual Pump Packages

A field installed flow switch (shipped loose from the factory) must be installed in the main glycol line. If flow is not established the flow switch closes the 24 VAC control circuit to a switch over relay and turns off the primary pump contactor after a time delay, and turns on the secondary pump.

The manual Primary/Secondary switch is mounted through the side of the pump package electric box. Normally the switch is in the “Primary” position which allows the controller to rotate the pumps (auto switch). Switching to the “Secondary” position manually overrides the primary pump control and only the secondary pump will operate. While in the “Secondary” position the pump package will also auto-switch to the primary pump in the event of a loss of coolant flow.

3.3 Microprocessor Controller Programming

The microprocessor controller is factory programmed based on the optional features selected. Most applications require no field start-up or program adjustment beyond setting the current date and time. Separate operating instructions for the controller have been sent with your unit, including each feature's factory "default" setting and the available adjustment range, if applicable.

4.0 MAINTENANCE/REPAIRS

4.1 Periodic General Maintenance

Systematic, periodic general maintenance of the CyberChiller unit is recommended for optimum system performance. General maintenance should include, but is not limited to the following: tightening electrical connections, cleaning the interior of the unit, inspecting the unit's components visually. Checking level of refrigerant and ensuring no moisture is in the refrigerant.

Use copies of the Periodic General Maintenance Checklist in this manual, (see Appendix A), to record periodic general maintenance inspections. For assistance, contact the SATS Product Support Group. Ensure adherence to all safety statements while performing any type of maintenance.

WARNING

Turn off power to the unit at the main power disconnect switch unless you are performing tests that require power. With power and controls energized, the unit could begin operating automatically at any time.

Hazardous voltage will still be present in the CyberChiller and condenser or dry cooler even with the unit turned off at the control panel. To isolate the unit for maintenance, turn off power at the main power disconnect switch.

Always disconnect main power prior to performing any service or repairs. To prevent personal injury, stay clear of rotating components because automatic controls may start them unexpectedly.

This unit employs high voltage equipment with rotating components. Exercise extreme care to avoid accidents and ensure proper operation.

4.1.1 General

- Check the "Y" strainer by removing the screen and checking for accumulations of particulate. Clean as required. (Monthly)
- Examine all wiring for signs of chafing, loose connections or other obvious damage. (Quarterly)
- Examine brackets, motor mounts and hardware for loose or missing parts or other damage. (Quarterly)
- Clean accumulations of dust and dirt from all interior and exterior surfaces. (Quarterly)

4.1.2 Compressor

The refrigerant compressor and its drive motor are hermetically sealed. The compressor crankcase has a lifetime supply of oil and the drive motor has permanently lubricated sealed bearings. Check the refrigerant charge using the sight glass while the unit is running. If low on charge, check for refrigerant leaks.

WARNING

Phosgene, a deadly, poisonous gas, is generated when refrigerant is exposed to flame. Always ensure adequate ventilation during refrigeration repairs.

This equipment should be serviced and repaired by a journeyman or a qualified refrigeration technician only.

Always recover all refrigerant prior to any system repairs, failure to do so may result in system over pressurization and rupture.

4.1.3 Outdoor Condenser/Fluid Cooler

Maintenance access to the condenser, (remote air cooled units) or dry cooler, (glycol cooled units) is through one or two removable panels (depending on model). Examine the areas around the air inlet and outlet grills, fans, motors and coils. Use a vacuum cleaner with a soft bristle brush to clean dirt from components. Clean the coil of all debris that will inhibit airflow. This can be done with a soft brush and compressed air or with a commercial coil cleaner. Check for bent or damaged coil fins and repair as necessary. Do not permit snow to accumulate on or around the condenser or dry cooler in the winter. Check all refrigerant lines and capillaries or coolant lines for vibration isolation and support as necessary. Check all refrigerant and coolant lines for signs of leaks.

4.2 Troubleshooting

WARNING

Turn off all power to the unit before conducting any troubleshooting procedures, unless the procedure specifically requires the system to operate. Keep hands, clothing and tools clear of the electrical terminals and rotating components. Ensure that your footing is stable at all times.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
Unit Fails to Start	a. Incorrect phasing or voltage.	Correct phase or voltage input.
	b. Power failure.	Check power source, power inlet and fuses. Check control cables and connections.
	c. Overload protection tripped.	Check for cause of overload and re-set circuit breaker(s) or motor starter(s).
Suction Pressure Too Low	a. Loss of refrigerant (bubbles in sight-glass).	Locate leak and repair. Recharge system.
	b. Expansion valve stuck or obstructed (short cycle or continuous running).	Remove and clean or replace valve.
	c. Clogged drier/strainer (feels cold).	Replace with new drier/strainer.
Evaporator Coil Ices	a. Temperature setting too low	Increase temperature setpoint.
	b. Low refrigerant charge.	Find leak, repair and recharge system.
	c. Low water flow rate	Increase flow rate
Pump Fails to Start	a. Power failure.	Check main voltage power source input cable.
	b. Control transformer circuit breaker tripped.	Check for short circuit or ground fault; if none reset circuit breaker.
	c. Defective contactor.	Repair or replace.
	d. Motor starter protector tripped.	Reset motor starter protector and check amperage of motor. Compare to setting on motor circuit controller and adjust to FLA.
Control is Erratic	Wiring improperly connected or broken.	Check wiring against schematic diagram.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
Condenser Pressure too High	a. Non-condensable gas or air in the system.	Recover system and recharge. Install new drier/strainer.
	b. Condenser air intake is blocked.	Remove debris and clean condenser.
	c. Overcharge of refrigerant.	Reclaim excess refrigerant from system.
	d. Condenser fan not operating.	Check pressure/temperature operating switches and motor. Replace as needed.
	e. Condenser pressure regulating valve setting too high.	Adjust to obtain correct pressure.
		3. Air in system - bleed system.
		4. Check all strainers and clean if needed.
Condenser Pressure too Low	a. Loss of refrigerant (indicated by bubbles in sight glass).	Locate and repair leak. Recharge system.
	b. Condenser fan controls not set properly.	Adjust or repair controls.
Noisy Compressor	a. Expansion valve stuck in open position (abnormally cold suction line).	Ensure feeder bulb is tight on suction line. Check operation and superheat.
	b. Broken compressor valve (compressor knocking, suction pressure rises faster than 2lbs/min after shutdown).	Replace compressor.
	c. Worn or scarred compressor bearings.	Replace compressor.
	d. Liquid slugging.	System overcharged. Reclaim excess refrigerant.
	e. Scroll compressor not properly phased.	Phase correctly at main power source. **DO NOT REWIRE COMPRESSOR.**
Head Pressure Too High	a. Low condenser airflow. (Indicated by excessive warm air leaving the condenser fan).	Open air passages. Clean coil. Check condenser fan(s).
	b. Air or other non-condensible gas in system	Reclaim system and recharge. Install a new drier strainer.
	c. Overcharge of refrigerant.	Reclaim excess refrigerant from system.
	d. Condenser/drycooler fans not on.	Check main voltage power source to unit.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
Head Pressure is too Low	a. Loss of refrigerant (indicated by bubbles in the sight glass).	Repair leak and recharge system.
Suction Pressure too Low	a. Expansion valve stuck in the open position (indicated by abnormally cold suction line).	Repair or replace valve.
	b. Low charge, flash gas in liquid line (indicated by bubbles in sight glass).	Repair leak and recharge system.
	c. Clogged drier/strainer (feels cool to the touch).	Replace drier/strainer.
	d. Obstructed expansion valve (indicat ed by loss of capacity).	Replace valve.
	e. Loss of control fluid from expansion valve control head (indicated by bubbles in the sight glass).	Replace valve or control head.
Compressor Fails to Start	a. Temperature setpoint too high.	Adjust to desired temperature.
	b. Compressor internal protector is open.	Check compressor for short circuit or ground.
	c. Complete loss of refrigerant charge (low pressure safety switch).	Locate and repair leak. Recharge system.
	d. Condenser pressure too high (high pressure safety switch).	Check condenser for obstructions.
	e. Minimum off time has not expired.	Wait for time to expire.
System Short of Capacity	a. Low refrigerant (indicated by bubbles in sight glass).	Check for leaks Repair and recharge system.
	b. Expansion valve stuck or obstructed (short cycling or continuous running).	Remove valve and clear obstruction or replace valve.
	c. Clogged drier/strainer (feels cold).	Replace with new drier/ strainer.
Compressor Short Cycles	a. Low line voltage causing compressor to overheat.	Check power source for cause of low line voltage.
	b. Reduced flow rate.	Check pump and strainer.
	c. Lack of refrigerant	Check for leak. Repair and recharge system.

4.3 Field Service

It may be necessary to perform repairs on the refrigeration system. If field repairs are necessary, the following procedures apply:

NOTE

Do not attempt to make repairs without the proper tools.

4.3.1 Leak Detection

Several methods can be used to detect a leak in the refrigeration system. The most modern and easiest method is to use an electronic leak detector. Follow the manufacturer's directions and any leak can be quickly located. A second method is to use soap bubbles. Apply a solution of soapy water with a brush or sponge to the joints and connections in the refrigeration lines. A leak in the lines will cause bubbles to form.

NOTE

Halogen leak detectors are ineffective with R-407C refrigerant because unlike R-22 refrigerant, R-407C does not contain chlorine.

4.3.2 Leak Repair

When a leak is located, properly reclaim the remaining refrigerant charge before attempting repairs. Adjacent piping must be thoroughly cleaned by removing all paint, dirt and oily film. Use wire brush, sandcloth or sandpaper and wipe the area with clean, dry cloths. Protect nearby parts from heat damage by wrapping with water-soaked cloths

4.3.3 Refrigerant Piping

When replacing components within the cabinet of the unit, the following consumable materials are recommended: Use Silfos alloy for copper-to-copper (piping discharge or suction line repairs). Silver solder (Stay-Silv #45) and flux are to be used on copper-to-brass or copper-to-steel repairs. For liquid line repairs at the drier, strainer, sight glass, or expansion valve, use a 95 % tin to 5 % antimony solder with flux.

When component replacement is complete, remove all traces of flux. After any repair, pressure check the system, checking for leaks prior to recharging the system.

4.3.4 General Common Repairs/ Component Replacement

4.3.4.1 Compressor Failure

The compressor is the most important component of the air conditioner. Numerous safety devices are provided to protect the compressor from failing.

If a compressor failure has occurred, determine whether it is an electrical or a mechanical failure. An electrical failure will be indicated by the distinct pungent odor once the system has been opened. If a burnout has occurred, the oil will be black and acidic. A mechanical failure will have no burned odor and the motor will attempt to run, an abnormal or excessive noise may be present.

An analysis of the oil is the only way to ensure the proper procedure for cleaning the refrigerant system. Acid test kits are available from several manufacturers for measuring the acid level in the oil. These are capable of making accurate acid measurements, but if they are not available, a check of the oil by sight and smell can give a quick indication if contamination remains in the system. Since refrigeration oils vary in color, a sample of the new oil in the replacement compressor should be removed prior to installation and sealed in a small glass bottle for comparison purposes. If the oil has been exposed to refrigerant, the bottle should not be tightly capped, since the residual refrigerant may create a high pressure if tightly sealed and exposed to high temperature.

CAUTION ⚠

Avoid touching or contacting the gas and oil with exposed skin. Severe burns will result. Use long rubber gloves in handling contaminated parts.

All electrical connections should be checked to be sure that they are tight and properly made. Check all circuit breakers, contactors and wiring. The contactor should be examined and replaced if contacts are worn or pitted.

If there is acid in the oil, there has been an electrical failure which has caused the compressor motor to burn out. The acid diffuses throughout the refrigeration system and must be removed by using a burnout filter kit before a new compressor is placed in service. Not only must the compressor be replaced, but also the entire refrigeration circuit must be cleaned of the

harmful contaminants left by the burnout. See section 4.3.4.1.2 (Burn-Out/Acidic Cleanup) for the proper cleaning procedure.

CAUTION

Damage to a replacement compressor caused by improper system cleaning constitutes abuse under the terms of the warranty. This will **VOID THE COMPRESSOR WARRANTY.** Always consult the factory prior to replacing the compressor.

If there is no acid in the oil, there has been a mechanical failure. See section 4.3.4.1.1 (Standard Cleanout) for the proper cleaning procedure.

CAUTION

POE oil is used in systems with R-407C refrigerant. If a replacement compressor is provided, ensure that it is filled with POE oil before installing.

4.3.4.1.1 Standard Cleanout Procedure

CAUTION

Avoid touching or contacting the gas and oil with exposed skin. Severe burns will result. Use long rubber gloves in handling contaminated parts.

NOTE

Cleaning operations must be performed by a journeyman, refrigeration mechanic, or air conditioning technician.

1. Turn off power to the unit at the main power disconnect switch.
2. Remove the burned-out compressor and install the new compressor.
3. Remove the liquid line drier and install an oversized liquid line filter-drier (one size larger than the normal selection size).
4. Evacuate the system according to standard procedures. Normally, this will include the use of a high-vacuum pump and a low-vacuum micron gauge for measuring the vacuum obtained.
5. Recharge the system.
6. Turn on the power at the main power disconnect switch and start the system.

4.3.4.1.2 Burn-Out/Acidic Cleanup Procedure

NOTE

Cleaning operations must be performed by a journeyman, refrigeration mechanic, or air conditioning technician.

1. These systems should be cleaned using the suction line filter-drier method.
2. Turn off power to the unit at the main power disconnect switch.
3. Remove the burned-out compressor and install the new compressor.
4. Install a suction line filter-drier designed for acid removal.
5. Remove the liquid line drier and install an oversized liquid line filter-drier (one size larger than the normal selection size).
6. Check the expansion valve, sight glass and other controls to see if cleaning or replacement is required.
7. Evacuate the system according to standard procedures. Normally, this will include the use of a high-vacuum pump and a low-vacuum micron gauge for measuring the vacuum obtained.
8. Recharge the system through the access valve on the suction line filter-drier.
9. Turn on power at the main power disconnect switch and start the system.
10. The permanently installed suction line filter-drier permits small-system cleanup to be completed in one service call. The pressure drop across the suction line filter-drier should be measured during the first hour of operation. If the pressure drop becomes excessive, the suction line filter-drier should be replaced (See Sporlan Bulletin 40-10, for maximum recommended pressure drop (PSI) for suction line filter drier).
11. In 24 hours, take an oil sample. Observe the color and test for acidity. If the oil is dirty or acidic, replace the suction line filter-drier.
12. In 2 weeks, examine oil to determine if another suction line filter-drier change is necessary.

5.0 PRODUCT SUPPORT GROUP

SATS provides to its customers a Product Support Group (PSG) which not only provides technical support and parts but the following additional services, as requested: performance evaluations, start-up assistance and training.

5.1 Technical Support

The SATS Product Support Group (PSG) is dedicated to the prompt reply and solution to any problem encountered with a unit. Should a problem develop that cannot be resolved using this manual, you may contact PSG at (240) 529-1399 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST. If a problem occurs after business hours, dial the page number (301) 414-4514 and follow the steps below:

1. Wait for the dial tone.
2. Dial your telephone number (including area code).
3. Press the pound (#) key.
4. Wait for a busy signal.
5. Hang up the telephone.

One of our service technicians will return your call. When calling to obtain support, it is vital to have the following information readily available, (information is found on unit's nameplate):

- Unit Model Number (CCH-XXX-X-XX)
- SATS Item Number (123456)
- Unit Serial Number (1234567)
- Description of Problem

5.2 Obtaining Warranty Parts

Warranty inquires are to be made through the Product Support Group (PSG) at (240) 529-1399 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST. A service technician at SATS will troubleshoot the system over the telephone with a field service technician to determine the defect of the part. If it is determined that the part may be defective a replacement part will be sent UPS ground. If the customer requests that warranty part(s) be sent by any other method than UPS ground the customer is responsible for the shipping charges. If you do not have established credit with SATS you must provide a freight carrier account number.

A written (or faxed) purchase order is required on warranty parts and must be received prior to 12:00 p.m. for same day shipment. The purchase order must contain the following items:

- Purchase Order Number
- Date of Order
- SATS Stated Part Price (obtained from PSG)
- Customer Billing Address
- Shipping Address
- Customer's Telephone and Fax Numbers
- Contact Name
- Unit Model No., Serial No. & SATS Item No.

The customer is responsible for the shipping cost incurred for shipping the defective part(s) back to SATS. Return of defective part(s) must be within 30 days at which time an evaluation of the part(s) is conducted and if the part is found to have a manufacturing defect a credit will be issued.

When returning defective part(s) complete the Return Material Authorization Tag and the address label received with the replacement part.

See SATS Standard Warranty located in section one of this manual.

5.3 Obtaining Spare/Replacement Parts

Spare and replacement parts requests are to be made through the Product Support Group (PSG) by fax (301) 620-1396, telephone (240) 529-1399 or E-mail (parts@stulz-ats.com). Quotes are given for specified listed parts for a specific unit.

SATS accepts Visa and MasterCard. SATS may extend credit to its customers; a credit application must be prepared and approved (this process could take one week).

A 25% minimum restocking charge will be applied on returned stocked parts that were sold as spare/ replacement parts. If the returned part is not a stocked item, a 50% restocking charge may be applied. Additionally a Return Material Authorization Number is required when returning parts. To receive credit for returned repair/replacement parts, the parts must be returned to SATS within 30 days of the purchase date. Spare part sales over 30 days old will be considered final and the parts will remain the sole property of the ordering party.

APPENDIX A - FORMS

Stulz Air Technology Systems Inc.
Frederick, Maryland USA 21704
Telephone: (301) 620-2033 Facsimile: (301) 620-1396

Checklist for Completed Installation

- ❑ 1 Proper clearances for service access have been maintained around equipment.
- ❑ 2 Equipment is level and mounting fasteners (if applicable) are tight.
- ❑ 3 Piping completed to refrigerant or coolant loop (if required).
- ❑ 4 All field installed piping leak tested.
- ❑ 5 Refrigerant charge added (if required).
- ❑ 6 Incoming line voltage matches equipment nominal nameplated rating ± tolerances.
- ❑ 7 Main power wiring connections to the equipment, including earth ground, have been properly installed.
- ❑ 8 Customer supplied main power circuit breaker (HACR type) or fuses have proper ratings for equipment installed.
- ❑ 9 All wiring connections are tight.
- ❑ 10 Control wiring connections completed to evaporator and condenser/condensing unit (if required), including wiring to wall mounted control panel and optional controls.
- ❑ 11 Foreign materials have been removed from inside and around all equipment installed (shipping materials, construction materials, tools, etc.).
- ❑ 12 Compressors and pumps rotate freely without unusual noise.
- ❑ 13 Inspect all piping connections for leaks during initial operation.

NOTES

Stulz Air Technology Systems, Inc.
Frederick, Maryland USA 21704

CyberChiller Series

Telephone: (301) 620-2033
Facsimile: (301) 620-1396

Periodic General Maintenance Checks and Services Checklist

Date: _____ Prepared By: _____

Model Number: _____ Serial Number: _____

Item Number: _____

Monthly

Miscellaneous

- ❑ Check Glycol or Chilled Water for Air (bleed as required)
- ❑ Remote Condensing Unit Clean and Clear of Obstructions

Semi-Annually

- ❑ Check Refrigerant Charge (bubbles in sight-glass)
- ❑ Check Suction & Discharge Pressure
- ❑ Check Glycol Solution Concentration in System
- ❑ Test the Glycol Solution Inhibitors (flush if necessary)
- ❑ Tighten Electrical Connections
- ❑ Check Contacts on Contactors for Pitting
- ❑ Clean Unit as Necessary

Annually

- ❑ Inspect Glycol System for Leaks and Corrosion
- ❑ Conduct a Complete Check of All Services Listed Above and Clean Unit's Interior

Notes:

_____

_____

_____

_____

Signature: _____

*** If factory assistance is required for any reason, provide the model number, serial number, and SATS item number found on the unit nameplate. This will speed the process and ensure accuracy of information. ***

NOTES

Appendix B- Glossary

Definition of Terms and Acronyms

SATS - Stulz Air Technology Systems, Inc.

BTU/Hr - British Thermal Units Per Hour

CNDCT - Conductor

ESD - Electrostatic Discharge

º F - Degrees Fahrenheit

FLA - Full Load Amps

FOB - Freight on Board

HACR - Heating, Air Conditioning, Refrigeration

HP - Horse Power

Hz - Hertz

KVA - Kilo Volt Amps

kW - Kilowatt

LRA - Locked Rotor Amps

MAX CKT BKR - Maximum Circuit Breaker

MAX FUSE - Maximum Fuse

MCA - Minimum Circuit Ampacity

MSDS - Material Safety Data Sheet

NEC - National Electric Code

NFPA - National Fire Protection Agency

PH - Phase

PSG - Product Support Group

PSI - Pounds per Square Inch

PSIG - Pounds per Square Inch Gauge

RLA - Run Load Amps

R-Value - Thermal Resistance

R-22 - Refrigerant (HCFC-22)

R-407C - Blended Refrigerant

SPDT - Single Pole, Double Throw

TEV - Thermal Expansion Valve

V - Volt

VAC - Volt, Alternating Current

VFS - Vertical Floor System

Globally close to you

Stulz-ATS, located in Frederick, MD USA, is part of The STULZ Group with headquarters in Hamburg, Germany and production facilities world wide. Our network of manufacturer's representatives and sales partners span the globe, providing innovative solutions to your unique environmental control needs.

www.stulz-ats.com

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1572 Tilco Drive, Frederick, Maryland 21704
Phone: (301) 620-2033, Fax: (301) 662-5487
Email: info@stulz-ats.com

www.stulz-ats.com

ISO-9001:2001 Quality Registered

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Holsteiner Chaussee 283, D-22457 Hamburg
Phone: +49(40)55 85 269, Fax: +49(40)55 85 308
Email: products@stulz.de, www.stulz.com

Installation, Operation & Maintenance
Specifications are subject to change without notice